Space Weather Forecast

Issued on Sunday, 10 July 2022 at 01:11 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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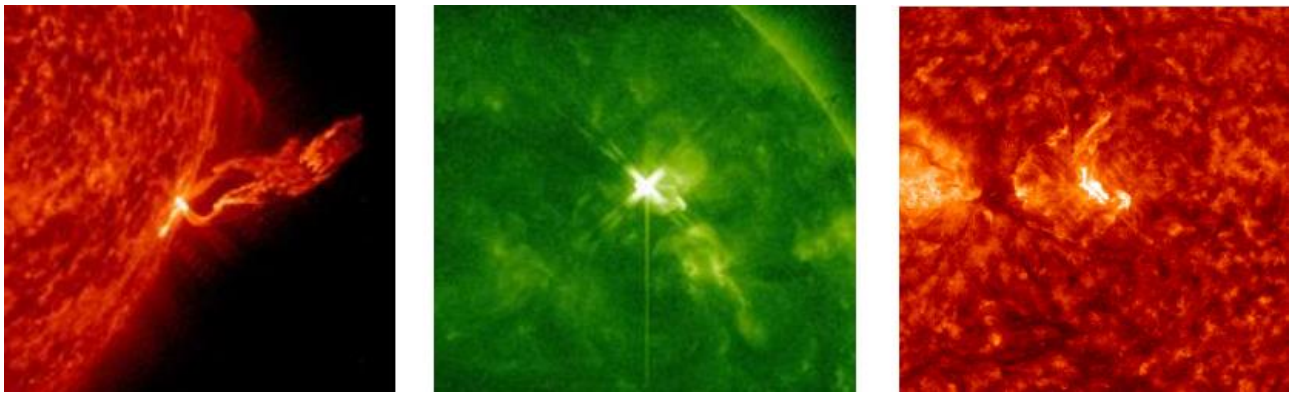
Space Weather Forecast Headline: Chance of further Moderate-class X-ray flares and R1/R2 Radio Blackouts. One CME pending analysis.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has reverted to low in the past 24 hours, with isolated common-class flares recorded, peaking with an upper-end common-class flare at 09/1348UTC. This emanated from a decayed remnant of a small bipolar sunspot group on the southwestern solar horizon. This was associated with a large non-Earth directed Coronal Mass Ejection (CME). Also of note was an impulsive middling common class flare at 09/2103UTC, with this emanating from the trailing portion of previously quiet sunspot group in the northwest. Finally, a third event in the form of a long-period common-class flare was observed at 09/2245UTC from immediately east of a small sunspot near the middle of the Sun's facing side. There is some evidence of a CME having been generated from this event. There is not yet any imagery to corroborate this, however being near the solar meridian, an Earth-directed component is very possible.

Figure 1: False-colour extreme UV imagery of the three most significant X-Ray flares in the past 24 hours. The rightmost may have produced a CME with an Earth-directed component, with assessment to be carried out once imagery becomes available.



There were five sunspot regions on the Sun in total, with the two largest and most complex both occupying the eastern solar hemisphere. The larger and historically more active of the two showed proliferation in its intermediate spots and some spreading, this group having produced a moderate class X-ray flare and non-Earth-directed CME prior to this reporting period at 08/2048UTC.

To its southeast, while smaller, a second sunspot group showed more change overall, with central spot development, areal growth and spreading observed, although no significant flare activity was recorded. All other sunspots were unremarkable and stable.

There are currently numerous large 'filaments' (arcs of plasma) on the Sun, with the southeastern quarter in particular harbouring two large features that each span roughly 20 degrees. There were

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no signs on instability in these in the reporting period, however they will become increasingly relevant should they lift off in the coming few days, and will be monitored.

No Earth-directed CMEs have been observed in available imagery over the past 24 hours. The aforementioned upper-end common class flare CME was modelled and determined to carry no Earth-directed component. A second CME from the western solar hemisphere was determined to be far-sided from an unknown source near 120 West (i.e. 30 degrees behind the western horizon), again with no Earth effects anticipated.

Solar Wind / Geomagnetic Activity: The solar wind generally followed a slow regime. The solar wind speed showed a slight decline within background levels at first, before a gradual recovery to regain this lost ground over the rest of the period. The number of particles comprising the solar wind was mainly within usual background levels, peaking in the middle of the UTC day. The magnetic field associated with these particles showed an early peak, with the north-south component spending much of the first half of the day co-aligned with Earth's field (to limit effects), before a more erratic character took over later in the afternoon and evening.

The net result of the above solar wind measures was nevertheless almost entirely quiet over the 24 hours, well below Minor Geomagnetic Storm G1 throughout.

Energetic Particles / Solar Radiation: Solar radiation showed a response in the lower end of the spectrum in the wake of the common class flare from the better-connecting (with Earth) western solar horizon, rising to a peak of around 4pfu in the following hours (on a scale where 10pfu is S1), maintaining this level into the UTC evening. The harder end of the spectrum was relatively unresponsive to the same stimulus.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain low, but with a daily chance of moderate-class flares. A progressive slight increase is possible in the four days, with the sunspots that present the greatest risk of flares still in the eastern solar hemisphere (therefore far from departing over the western horizon), possibly bolstered by further arrivals over the northeastern horizon into the new working week UTC.

Solar Wind / Geomagnetic Activity: No CMEs feature in this forecast.

Solar winds are expected to follow a slow regime initially. Recent measurements from an upwind satellite suggest effects from a coronal hole fast wind may present at Earth from Monday 11 July, albeit with low confidence for bearing little resemblance to last rotation and possessing a very fragmented leading edge (complicating forecasting the arrival time). All considered, there is a slight chance of a G1/Minor Storm at this time, reducing to more reliably quiet levels once again towards midweek.

Energetic Particles / Solar Radiation: In the absence of any significant sunspot development, there is a daily slight chance of S1 or greater, with risks from the southwest solar horizon feature bolstered by the westward progression of the front-sided large sunspot groups.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	20	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	5	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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